

REMARKS

The Office Action of December 8, 2006 rejects Claims 1-7 and 12-20 on the grounds that the phrase "wherein a sliding frictional coefficient of the outer surface of the crucible to a carbon member at 1,500°C is more than 0.6". See paragraph no. 4 on page 2 of the Office Action. None of Claims 1-2, 4-5, and 1-14 include the phrase to which the Office objects in paragraph no. 4 of the Office Action. Thus, the rejection of at least the aforementioned claims for indefiniteness is not supportable and should be withdrawn.

Applicants draw the Offices attention to new dependent Claims 24-26 which require that the carbon member is a graphite susceptor.

Moreover, the Office's assertion that one of ordinary skill in the art would not be able to tell the difference between a carbon member and a non-carbon member is not supportable. A carbon member is made from carbon. A non-carbon member is not made from carbon. It is difficult to imagine a more clear distinction. The Office's rejection of the claims is therefore not supportable and should be withdrawn.

On page 3 of the Office Action the Office asserts that the recitation of grooves having a length of less than 200µm and a width of less than 30µm and a depth of from more than 3 to less than 30µm is not limiting because grooves having a length and width of zero are not grooves. Applicants submit that the Office's reasoning is circular and makes no sense. The claims require the presence of "grooves". Applicants submit that grooves necessarily have a definite length and width or else they would not be grooves.

The Office's interpretation of the claims ignores this feature of the term grooves. It is in fact impossible for a groove to have a length and width of zero and the Office's assertion that this impossibility is a reasonable interpretation of the claims is without merit. Applicants submit the Office's interpretation is not reasonable and, in fact, is contrary to the plain meaning of the terms in the claims.

The Office further objected to the phrase “used for pulling silicon single crystal”. The present claims are drawn to a silica glass crucible. Those of ordinary skill in the art readily recognize that the claimed crucible has a certain functionality and purpose in the microelectronics industry; namely, as a reservoir for holding molten silicon for pulling up single crystal silicon (see paragraph [0006] on page 4) i.e., for carrying out a CZ (Czochralski) process. The phrase objected to by the Office serves to make it clear that the silica glass crucible of the claims is one that must be able to provide certain functionality. In order to provide such a functionality certain structural characteristics must be present. Namely, the silica glass crucible must be able to hold molten silicon in sufficient volume and quantity at an elevated temperature (e.g., 1,500°C) during a process in which silicon single crystal is made (i.e., a CZ process).

The above-noted distinction is important because it appears that the Office does not understand that the silica glass jig of the cited prior art (i.e., Segawa, US2002/0078886) is necessarily different from the claimed silica glass crucible. The silica glass jig of Segawa is described as follows:

The silica glass jig for semiconductor industry of the invention is a jig, which is used in a semiconductor industry such as, for example, a furnace core tube, a boat for placing a wafer, etc., and on the surface of the jig, there are pyramidal projected structures with their cut-off apices and also small projections are further uniformly distributed on the smooth portions between them.

See paragraph [0009] of Segawa.

The above-quoted description of the prior art silica glass jig is sufficient to distinguish the claimed invention from the prior art. None of the prior art silica glass jigs may be used to carry out a CZ process at least because the structural characteristics of a furnace core tube and/or a boat for placing a wafer cannot accommodate molten silicon in an amount sufficient for carrying out a CZ process (e.g., pulling up single crystal silicon).

The Office appears to be of the opinion that a silica glass jig is the same as a silica glass crucible but provides no support for such an interpretation. As noted above, a silica glass jig can not provide the functionality of a silica glass crucible.

For clarity, Applicants provide the table below as a comparison of the silica glass crucible of the present claims and the silica glass jig of Segawa.

Table 1 Comparative Table of Present Application (JSQ) and US2002/0078886A1

	JSQ	US2002/0078886A1
Industrial Field	A crucible for using to make a single crystal silicon by Czochralski method.	A silica glass jig for semiconductor industry, for example, a furnace core tube, a boat for placing a wafer, etc.
Material	Silica glass	Silica glass
Using conditions	The crucible is used when melting poly-crystal silicon and pulling up a single crystal silicon at a high temperature. The crucible is supported by a graphite susceptor.	These jigs are used in a process of coating SiO ₂ , Si ₃ N ₄ , or poly-crystal silicon, etc. on a silicon wafer.
Problems to be solved	When pulling up a single crystal silicon for long time (10 hr. or more) at high temperature (about 1,420°C), deformation of the crucible (Buckling and Sinking) occurs and affects bad influence for making the single crystal silicon. (See Fig. 1)	The films, such as SiO ₂ , Si ₃ N ₄ , or poly-crystal silicon, etc. are also coated on the surfaces of these jigs. When the thickness of the coated material becomes thicker than a definite thickness, by the difference in the thermal expansion coefficients between the jig and the coated material, a stress is generated to cause peeling off or form particles, which cause to contaminate the semiconductor elements.
Objective	To prevent the deformation of the crucible at high temperature by increasing friction between the outer periphery face of the crucible and the graphite susceptor.	To prevent generating peeling off films or forming particles.

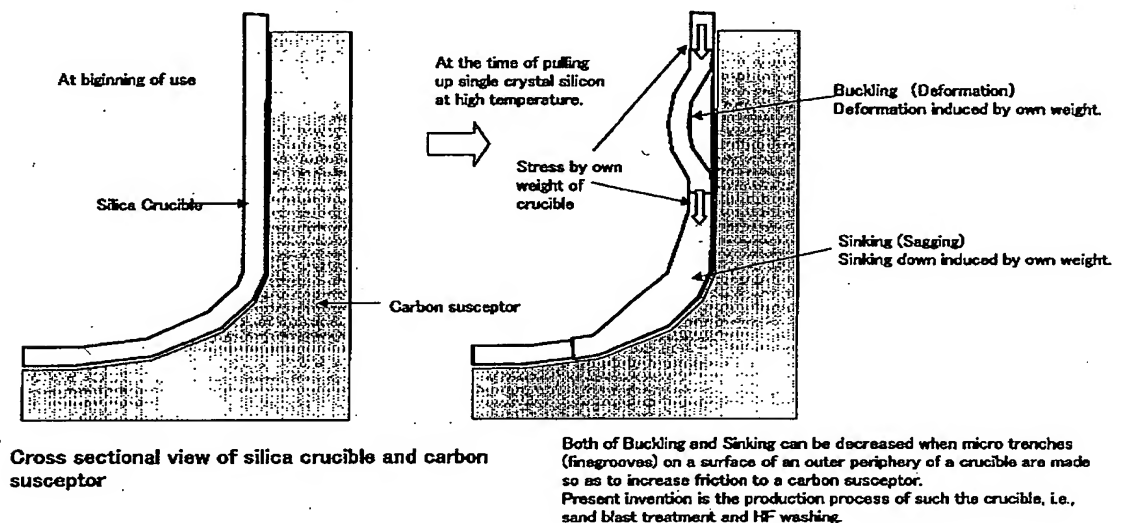
The table above shows that many aspects of silica glass jigs are different from silica glass crucibles. For example, crucibles and jigs are in different fields, are used under different conditions and have substantially different functionality as evidenced by the problems to be solved.

One important aspect of the claimed silica crucible is the ability to solve problems such as buckling and sagging that occur in conventional silica glass crucibles. In order to illustrate this aspect of the invention, the following figure is provided. In the following figure, the sinking and buckling that is observed in prior art glass crucibles is shown. The sinking and buckling is caused by poor adhesion between the glass crucible and a carbon susceptor. The glass of the silica glass crucible therefore "slips" and sags or buckles thereby making its use in a silicon pulling up process difficult. The presently claimed invention addresses these problems.

Fig.1 Explanation of Sinking and Buckling

The word "Sinking" is used for meaning "sinking down". Some makers producing single crystal silicon call this phenomenon as "Sagging".

The word "Buckling" is used for meaning "deformation of a crucible" in which a crucible wall deforms inside swelling at an inner periphery thereof at a high temperature. This phenomenon is induced by the own weight of the crucible and, sometimes, merely called as "Deformation".



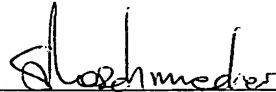
Applicants draw the Office's attention to new dependent Claims 21-23. The new dependent claims state that the silica glass crucible further comprises a carbon susceptor adhered to the silica glass crucible. Segawa does not disclose or suggest the silica glass crucibles of Claims 21-23 and thus the subject matter of the new dependent claims is further patentable over the cited prior art.

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For the reasons discussed above, Applicants submit that all now-pending claims are in condition for allowance and request the mailing of a Notice of Allowance acknowledging the patentability of the presently claimed subject matter.

Respectfully submitted,

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